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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/721,522	11/24/2003	Yasuhiko Sugiyama	S004-5168	5320

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EXAMINER

ROSASCO, STEPHEN D

ART UNIT	PAPER NUMBER
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1756

DATE MAILED: 11/23/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/721,522

Applicant(s)

SUGIYAMA ET AL.

Examiner

Stephen Rosasco

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 20 October 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-9 is/are pending in the application.
- 4a) Of the above claim(s) 7-9 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-6 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 24 November 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☒ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

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Detailed Action

Applicant's election with traverse of Group I (claims 1-6) in the reply filed on 10/20/05 is acknowledged. However no grounds of traversal were discussed. Therefore, the requirement is still deemed proper and is made FINAL.

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1-6 are rejected under 35 U.S.C. 102(e) as being anticipated by Stewart et al. (US 20040151991 A1).

Stewart et al. teach a method for repairing a opaque defect in a photolithography mask, comprising: directing an ion beam toward an area of the mask including the defect to remove material, the ion beam incidentally implanting atoms into the mask, thereby reducing its transparency; and directing an electron beam toward the area of the mask to remove a layer of the mask containing the implanted atoms and to increase the transparency of the area.

And in which directing an electron beam toward the area of the mask includes directing an etchant gas toward the area of the mask.

Stewart et al. also teach (see [0035]) Focused ion beam column 302 includes an ion source 308, preferably a gallium liquid metal ion source (LMIS). Other ion sources that

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could be used include a silicon/gold eutectic LMIS and a plasma ion source, depending upon the repair strategy. By using a mask simulation program as described above, skilled persons would be able to determine the effects of the implantation of materials other than gallium and use those effect to effect repair of defects. The column can use a focused beam or a shaped beam. The invention is not limited to any particular type of charged particle beam column.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Neary (5,882,823) or Yang (6,096,459) in view of Stewart et al. (US 20040151991 A1) or Kanamitsu et al. (US 20030215722 A1)

The claimed invention is directed to a mask correction method, in a correction process for removing redundant sections such as photomask opaque defects or phase shifter bump defects, comprising the steps of: coarse correction by etching using a focused ion beam;

and finishing correction by etching using an electron beam.

And comprising, before the coarse correction, a step of acquiring an SEM image using an electron beam, and a step of positioning defect correction locations on the SEM image.

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And wherein the finishing processing using an electron beam is carried out while spraying etching assist gas to a beam irradiation position.

And wherein the coarse correction is carried out to leave part of the defect, and finishing processing is performed on the remaining part.

And wherein, when the defect is an opaque defect, the coarse correction removes the entire opaque defect.

Neary teaches a method of repairing a mask comprising the steps of: (a) providing a substrate;

(b) shining a beam on a portion of said substrate to remove a portion of said substrate and to leave a portion of said substrate comprising a thin wall; and

(c) providing a second removal step to substantially remove said thin wall, wherein said second removal step comprises a process different from said shining step (b).

wherein said shining step (b) comprises the step of shining a focused ion beam.

And further comprises isotropically etching said thin wall while said conductive coating remains in place to protect other portions of the mask during said isotropic etching step.

Yang teaches a method for removing a bump defect from a lithographic template, comprising the steps of: providing a lithographic template having a substrate layer and a patterned opaque layer on the substrate layer;

locating a bump defect on the template;

directing a high energy focused ion beam at the bump defect for a time sufficient to drive ions into the entirety of the bump defect; and etching the template containing the ion beam implanted bump defect with a basic solution to remove the bump defect.

And wherein said step of locating a bump defect comprises scanning with a scanning electron microscope.

The teachings of Neary or Yang differ from those of the applicant in that the applicant teaches the use of an electron beam after etching the defect with the FIB.

Stewart et al. teach a method for repairing a opaque defect in a photolithography mask, comprising: directing an ion beam toward an area of the mask including the defect to remove material, the ion beam incidentally implanting atoms into the mask, thereby reducing its transparency; and directing an electron beam toward the area of the mask to remove a layer of the mask containing the implanted atoms and to increase the transparency of the area.

And in which directing an electron beam toward the area of the mask includes directing an etchant gas toward the area of the mask.

Stewart et al. also teach (see [0035]) Focused ion beam column 302 includes an ion source 308, preferably a gallium liquid metal ion source (LMIS). Other ion sources that could be used include a silicon/gold eutectic LMIS and a plasma ion source, depending upon the repair strategy. By using a mask simulation program as described above, skilled persons would be able to determine the effects of the implantation of materials other than gallium and use those effect to effect repair of defects. The column can use a focused beam or a shaped beam. The invention is not limited to any particular type of charged particle beam column.

Kanamitsu et al. teach a photomask repair method for repairing a defect of a photomask; comprising: applying an electron beam shaped through a beamshaping aperture to a region to be etched including a defective portion of the photomask under an atmosphere of a gas capable of effectively performing a chemical etching of a film material for forming a pattern of the photomask, thereby etching the defective portion; scanning an electron beam converged to be fine across a predetermined area around the defective portion, thereby permitting secondary electrons to emit to produce a pattern image, obtaining an electron intensity profile in the perpendicular direction to an edge of the pattern image produced above, thereby identifying the position of the profile corresponding to an end of the defective portion; and performing repair of the photomask while performing etching and identification, repeatedly, and terminating the etching when the edge of the defective portion reaches a proper position.

And wherein the gas capable of effectively performing chemical etching of a film material is a halogen gas or a gas mixture containing a plurality of halogen elements.

It would have been obvious to one having ordinary skill in the art to take the teachings of Neary or Yang and combine them with the teachings of Stewart et al. or Kanamitsu et al. in order to make the claimed invention because electron beam etching is known to be used for etching finer regions than FIB because of the smaller size, momentum and better focus of an electron beam.

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Conclusion

Any inquiry concerning this communication or earlier communications from the Examiner should be directed to Stephen Rosasco whose telephone number is (571) 272-1389. The Examiner can normally be reached Monday-Friday, from 8:00 AM to 4:30 PM. The Examiner's supervisor, Mark Huff, can be reached on (571) 272-1385. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



S. Rosasco
Primary Examiner
Art Unit 1756

S. Rosasco
11/11/05